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**Reference: NAG5-8063: Pulsar Wind Nebulae, Space Velocities and Supernova
Remnant Associations LTSA-98**

To Whom It May Concern:

The Center for Space Research at the Massachusetts Institute of Technology submits this Progress Report for NAG5-8063.

Sincerely,

A handwritten signature in cursive script, appearing to read "Joan G. Boughan".

Joan G. Boughan
Fiscal Officer

cc: R. Oliverson Code 681
D. Burfoot Code 210.G
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File 6807000

ENCLOSURE FOR NAG5-8063

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MIT SPACE RESEARCH CENTER

This is a progress report for Pulsar Wind Nebulae, Space Velocities and Supernova Remnant Assoc. LTSA-98 NAG5-8063 MIT 6807000.

I am pleased to be able to report significant progress in my research relevant to my LTSA grant. This progress I believe is demonstrated by a long list of publications in 2002, as detailed below. I summarize the research results my collaborators and I obtained in 2002. First, my group announced the major discovery of soft-gamma-repeater-like X-ray bursts from the anomalous X-ray pulsars 1E~1048.1\$-5937 and 1E~2259+586, using the Rossi X-ray Timing Explorer. This result provides an elegant and long-sought-after confirmation that this class of objects and the soft gamma repeaters share a common nature, namely that they are magnetars. Magnetars are a novel manifestation of young neutron stars, quite different from conventional Crab-like radio pulsars. This discovery was made as part of our regular monitoring program, among the goals of which was to detect such outbursts. In addition, the same monitoring program resulted in interesting results for all known anomalous X-ray pulsars on regular timing, pulsed flux monitoring and pulse morphology monitoring that were described in two papers in 2002. In addition, collaborators and I did significant X-ray work on the young radio pulsar PSR B1509-58 and its wind nebula using the Chandra X-ray Observatory, and I also participated in studies of two globular clusters using Chandra. Below is a list of publications related to this research.

Gavriil, F. P., Kaspi, V. M., Woods, P. "Magnetar-like X-ray Bursts from an Anomalous X-ray Pulsar," *Nature*, 419, 142-144, 2002.

Kaspi, V. M., Gavriil, F. P., Woods, P. M., June 19, 2002, "1E 2259+586," *International Astronomical Union Circular No. 7924*.

Kaspi, V. M., Gavriil, F. P., Woods, P. M., June 24, 2002, "1E 2259+586," *International Astronomical Union Circular No. 7926*.

Kaspi, V. M., Jensen, J., Rigaut, F., A. Hatekeyama, Woods, P. M., June 24, 2002, "1E 2259+586," *International Astronomical Union Circular 7926*.

Pooley, D. et al. "Chandra Observations of the Globular Cluster NGC 6440 and the Nature of Cluster X-ray Luminosity Functions," *Astrophys. J.*, 573, 184--190, 2002. (10 authors)

Pooley, D. et al. "Optical Identification of Multiple Faint X-ray Sources in Globular Cluster NGC 6752: Evidence for Numerous Cataclysmic Variables," *Astrophys. J.*, 569, 405--417, 2002. (11 authors)

Gaensler, B. M., Arons, J., Kaspi, V. M., Pivovarov, M. J., Kawai, N., Tamura, K. "Chandra Imaging of the X-ray Nebula Powered by PSR B1509-58," *Astrophys. J.*, 569, 878--893, 2002.

Gavriil, F. P., Kaspi, V. M. "Long-term Rossi X-ray Timing Explorer Monitoring of Anomalous X-ray Pulsars," *Astrophys. J.*, 567, 1067--1076, 2002.

Gotthelf, E. V., Gavriil, F. P., Kaspi, V. M., Vasisht, G., Chakrabarty, D. "A Phase-coherent Timing Solution for Magnetar Candidate 1E 1841\$-5045," *Astrophys. J. (Letters)*, 564, L31--L34, 2002.